

REMARKS

Claims 1, 3, 6, and 9-20 are pending in the Application. Claim 3 has been amended to change its dependence in view of the cancellation of claim 2. Claims 6, 12, 13, 14, and 16 have been amended to overcome the § 112 rejections at paragraph 2 of the Office Action. Reconsideration and withdrawal of the remaining rejections are requested in view of the following amendments and remarks.

The claims describe a system and method for cleaning semiconductor wafer boxes. The cleaning system includes straight spray nozzles and at least one angle spray nozzle for cleaning boxes and a rotor having box holding positions for holding and rotating the boxes during cleaning. In a preferred embodiment, the straight spray nozzles spray fluid toward the center or spin axis of the rotor. The angle spray nozzles spray fluid at an angle relative to that of the straight spray nozzles.

Turning to the prior art, none of the cited references disclose these claimed features. With respect to the § 102 rejections of claims 1-16 at paragraph 4 of the Office Action, Manos does not disclose a system for cleaning wafer boxes, but rather discloses a system for cleaning wafers in a megasonic tank (Abstract). The wafers are supported on a rotating carrier 1, or rotor, having a central axis about which the carrier rotates (Abstract; col. 4, lines 11-14). The carrier 1 includes spaced grooves 10 and rods 11 for holding wafers, not boxes, on the carrier 1 during rotation and cleaning of the wafers (col. 3, lines 31-37). Manos does not disclose a rotor having box positions for holding boxes, or the step of placing boxes in or on a rotor, as recited in each of the claims.

Additionally, with respect to claims 9 and 11, Manos does not disclose an angle spray nozzle that sprays a second spray in a direction toward or opposite the direction of rotation of the rotor, as claimed. Rather, each of the nozzles 31 in Manos direct spray along an axis perpendicular to the

direction of rotation, i.e., toward the central axis, of the carrier 1 (Figs. 6 and 7). The upper nozzles 31 in Figs. 6 and 7 are pointed at an angle because the tank 26 is rectangular, as opposed to circular, so the nozzles 31 must be angled to direct spray inwardly toward the central axis of the carrier 1. There is no suggestion in Manos to direct spray toward or opposite the direction of rotation of the carrier 1. Furthermore, there is no motivation to do so, since the spray in Manos is used to rinse flat wafers (col. 5, lines 41-42), not to clean three-dimensional boxes having regions that may be difficult to reach with only radially inwardly directed sprays.

With respect to claim 12, Manos does not disclose a spray manifold having two angle nozzles separated by at least two straight spray nozzles, as claimed. Rather, Manos discloses nozzles 31 located around the sides 27 of the tank 26 (col. 5, lines 13-15). The angled nozzles shown in Figs. 6 and 7 are not separated by at least two straight spray nozzles on a manifold. Even if additional nozzles were added to the sides 27 of the tank 26, they would be angled so that they could direct spray toward the central axis of the carrier 1, as explained above. In other words, there is no suggestion or motivation to have two straight nozzles located in succession on any of the sides 27 of the tank 26 in Manos. Accordingly, two angle nozzles are not separated by at least two straight nozzles, as claimed.

With respect to claim 13, Manos does not disclose a second spray that is sprayed at an angle relative to a first spray, with both sprays being horizontal, as claimed. Rather, the angled spray in Manos is directed at a downward angle relative to horizontal (Figs. 6 and 7).

Turning to the § 102 rejection of claim 16 at paragraph 5 of the Office Action, Thompson et al. does not disclose spraying a first spray from a first set of nozzles on a manifold in a direction different than a second spray from a second set of nozzles on the manifold, as claimed. Rather,

Thompson describes all of the spray nozzles on a given manifold being pointed directly “inward or directly towards the central axis of the processing chamber,” (col. 6, lines 24-25), or “generally outward or [in a] radial direction toward the rotor” (col. 6, lines 60-64). Additionally, Figure 7 in Thompson et al. shows the liquid spray nozzles 93 all directed inwardly and pointing straight. Consequently, there is no second set of nozzles on a manifold that sprays a second spray in a direction different from a first set of nozzles on the manifold.

New claim 17 recites a rotor having a box position for holding a multi-sided wafer carrier box during cleaning of the box. New claim 18 recites a rotor that is rotatable about a vertical axis. New claim 19 recites that an angle spray nozzle sprays fluid toward the vertical axis of the rotor at an upward or downward angle relative to a horizontal axis of fluid sprayed from straight spray nozzles. New claim 20 recites that an angle spray nozzle sprays fluid horizontally toward the rotor at an angle relative to a horizontal axis of fluid sprayed from straight spray nozzles, such that a central axis of the fluid sprayed from the angle spray nozzle is not directed at the vertical axis of the rotor. Support for the new claims is found throughout the specification.

Neither of the cited references disclose all of the features of any of the new claims. Moreover, there is no suggestion to combine the teachings of Thompson et al. with those of Manos, since Thompson teaches a cleaning system having a vertical rotor for holding boxes, and Manos teaches a cleaning system having a horizontal rotor for holding wafers.

In view of the foregoing, it is submitted that the Application is in condition for allowance. A  
Notice of Allowance is therefore requested.

Respectfully submitted,

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**CLAIM SHEETS MARKED UP TO SHOW CHANGES MADE**

3. (Amended) The cleaning system of claim [2] 10 where the angle is from 30-60 degrees.

6. (Amended) A method for cleaning five sided boxes [of the type] used for carrying and storing semiconductor wafers, comprising the steps of:

placing the boxes in or on a rotor with [the] an open side of the box facing radially outwardly and away from [the] a center of the rotor;

spinning the rotor holding the boxes;

spraying a first spray of a cleaning liquid towards the center or spin axis of the rotor; and

spraying a second spray of the cleaning liquid at an angle relative to the first spray.

12. (Amended) A cleaning system for cleaning boxes used for moving and storing semiconductor wafers, comprising:

an enclosure;

a rotor rotatably supported within the enclosure, with the rotor having box positions for holding a box;

a plurality of spray manifolds positioned to spray a cleaning or rinsing fluid towards the rotor, with at least one of the spray manifolds having a plurality of straight spray nozzles[, wherein the manifold has] and two angle nozzles separated by at least two straight spray nozzles.

13. (Amended) A method for cleaning five sided boxes [of the type] used for carrying and storing semiconductor wafers, comprising the steps of:

placing the boxes in or on a rotor with [the] an open side of the box facing radially outwardly and away from [the] a center of the rotor;

spinning the rotor holding the boxes;

spraying a first spray of a cleaning liquid towards the center or spin axis of the rotor; and

spraying a second spray of the cleaning liquid at an angle relative to the first spray;

where the first spray is sprayed in a pattern having a centerline or center axis which is horizontal, and where the second spray is also sprayed in a pattern having a centerline which is horizontal.

14. (Amended) A method for cleaning five sided boxes [of the type] used for carrying and storing semiconductor wafers, comprising the steps of:

placing the boxes in or on a rotor with [the] an open side of the box facing radially outwardly and away from [the] a center of the rotor;

spinning the rotor holding the boxes;

spraying a first spray of a cleaning liquid towards the center or spin axis of the rotor; and

spraying a second spray of the cleaning liquid at an angle relative to the first spray, with the first spray oriented horizontally and the second spray oriented upwardly or downwardly at an angle relative to the first spray.

16. (Amended) A method for cleaning boxes [of the type] used for carrying and storing semiconductor wafers, comprising the steps of:

placing the boxes in or on a rotor;

spinning the rotor holding the boxes;

spraying a first spray of a liquid from a first set of nozzles on a manifold in a first direction towards the boxes; and

spraying a second spray of the liquid from a second set of nozzles on the manifold in a second direction different from the first direction.

**CLEAN SET OF PENDING CLAIMS**

1. A cleaning system for cleaning boxes used for moving and storing semiconductor wafers, comprising:  
an enclosure;  
a rotor rotatably supported within the enclosure, with the rotor having box positions for holding a box;  
a plurality of spray manifolds positioned to spray a cleaning or rinsing fluid towards the rotor, with at least one of the spray manifolds having a plurality of straight spray nozzles, and also having at least one angle spray nozzle.

~~SUB E1 51~~ (Amended) The cleaning system of claim ~~10~~<sup>4</sup> where the angle is from 30-60 degrees.  
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~~SUB E1 21~~ (Amended) A method for cleaning five sided boxes used for carrying and storing semiconductor wafers, comprising the steps of:

~~B2~~  
placing the boxes in or on a rotor with an open side of the box facing radially outwardly and away from a center of the rotor;  
spinning the rotor holding the boxes;  
spraying a first spray of a cleaning liquid towards the center or spin axis of the rotor; and  
spraying a second spray of the cleaning liquid at an angle relative to the first spray.



C 9. The method of claim <sup>6</sup>/<sub>7</sub> where the center axis of the first spray is aimed at the center of the rotor, and the centerline of the second spray is aimed at an angle to the first spray, so that the second spray sprays a pattern of liquid in a direction towards or opposite to the spin direction of the rotor.

10. A cleaning system for cleaning boxes used for moving and storing semiconductor wafers, comprising:

an enclosure;

a rotor rotatably supported within the enclosure, with the rotor having box positions for holding a box;

a plurality of spray manifolds positioned to spray a cleaning or rinsing fluid towards the rotor, with at least one of the spray manifolds having a plurality of straight spray nozzles, and also having at least one angle spray nozzle, wherein the straight spray nozzles spray in a pattern having a horizontal central axis, and the angle spray nozzle sprays in a pattern having a central axis extending upwardly or downwardly at an angle relative to the horizontal central axis.

11. A cleaning system for cleaning boxes used for moving and storing semiconductor wafers, comprising:

an enclosure;

a rotor rotatably supported within the enclosure, with the rotor having box positions for holding a box;

a plurality of spray manifolds positioned to spray a cleaning or rinsing fluid towards the rotor, with at least one of the spray manifolds having a plurality of straight spray nozzles, and also having at least one angle spray nozzle, wherein the angle spray nozzle is oriented to spray in a pattern having a central axis directed opposite to the direction of rotation of the rotor.

*Sub E1* 7. (Amended) A cleaning system for cleaning boxes used for moving and storing semiconductor wafers, comprising:

an enclosure;

a rotor rotatably supported within the enclosure, with the rotor having box positions for holding a box;

*B3* a plurality of spray manifolds positioned to spray a cleaning or rinsing fluid towards the rotor, with at least one of the spray manifolds having a plurality of straight spray nozzles and two angle nozzles separated by at least two straight spray nozzles.

*8* 13. (Amended) A method for cleaning five sided boxes used for carrying and storing semiconductor wafers, comprising the steps of:

placing the boxes in or on a rotor with an open side of the box facing radially outwardly and away from a center of the rotor;

spinning the rotor holding the boxes;

spraying a first spray of a cleaning liquid towards the center or spin axis of the rotor; and

spraying a second spray of the cleaning liquid at an angle relative to the first spray;

Sub E1) where the first spray is sprayed in a pattern having a centerline or center axis which is horizontal, and where the second spray is also sprayed in a pattern having a centerline which is horizontal.

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14. (Amended) A method for cleaning five sided boxes used for carrying and storing semiconductor wafers, comprising the steps of:

placing the boxes in or on a rotor with an open side of the box facing radially outwardly and away from a center of the rotor;

spinning the rotor holding the boxes;

63 spraying a first spray of a cleaning liquid towards the center or spin axis of the rotor; and

spraying a second spray of the cleaning liquid at an angle relative to the first spray, with the first spray oriented horizontally and the second spray oriented upwardly or downwardly at an angle relative to the first spray.

15. A cleaning system for cleaning boxes used for moving and storing semiconductor wafers, comprising:

an enclosure;

a rotor rotatably supported within the enclosure, with the rotor having box positions for holding a box;

a plurality of spray manifolds positioned to spray a cleaning or rinsing fluid towards the rotor, with at least one of the spray manifolds having one or more first spray nozzles, and also

[ having one or more second spray nozzles, with the second spray nozzles at an angle of 10-80 degrees to the first spray nozzles.

SUB E1) 11/16. (Amended) A method for cleaning boxes used for carrying and storing semiconductor wafers, comprising the steps of:

placing the boxes in or on a rotor;

spinning the rotor holding the boxes;

B4 spraying a first spray of a liquid from a first set of nozzles on a manifold in a first direction towards the boxes; and

spraying a second spray of the liquid from a second set of nozzles on the manifold in a second direction different from the first direction.

17. (New) A cleaning system for cleaning boxes used for moving and storing semiconductor wafers, comprising:

an enclosure;

B \$ a rotor rotatably supported within the enclosure, with the rotor having a box position for holding a multi-sided wafer carrier box during cleaning of the box; and

a spray manifold positioned to spray a cleaning or rinsing fluid toward the rotor, with the spray manifold having a plurality of straight spray nozzles, and also having at least one angle spray nozzle.

18. (New) A cleaning system for cleaning boxes used for moving and storing semiconductor wafers, comprising:

an enclosure;

a rotor rotatably supported within the enclosure and rotatable about a vertical axis, with the rotor having a box position for holding a box;

a spray manifold positioned to spray a cleaning or rinsing fluid toward the rotor, with the spray manifold having a plurality of straight spray nozzles that spray fluid along a horizontal axis toward the vertical axis of the rotor, and also having at least one angle spray nozzle.

19. (New) The cleaning system of claim 18 wherein the angle spray nozzle sprays fluid toward the vertical axis of the rotor at an upward or downward angle relative to the horizontal axis of the fluid sprayed from the straight spray nozzles.

20. (New) The cleaning system of claim 18 wherein the angle spray nozzle sprays fluid horizontally toward the rotor at an angle relative to the horizontal axis of the fluid sprayed from the straight spray nozzles, such that a central axis of the fluid sprayed from the angle spray nozzle is not directed at the vertical axis of the rotor.